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SHIPPING TESTS WITH CALIFORNIA MATURE-GREEN TOMATOES, FALL 1951

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SHIPPING TESTS WITH CALIFORNIA MATURE-GREEN TOMATOES - FALL 1951

The purpose of these tests was to compare railroad protective services and to determine the effect of field temperatures before harvest and transit temperatures in refrigerator cars upon subsequent ripening of mature-green tomatoes shipped from the Tracy district of California to eastern markets during the fall. The results of ripening tests carried on for several years at the University of California, College of Agriculture, indicate that continued exposure to temperatures below 50°F before or after harvest may retard ripening of tomatoes picked at the mature-green stage and cause a reduction in the packout of marketable fruit from the ripening rooms. Recent tests by the Division of Handling, Transportation, and Storage, U. S. Department of Agriculture show that the resistance of mature-green tomatoes to certain decay organisms is reduced by exposure to low temperature.

With the current tests made during October and early November, temperature records obtained in tomato fields prior to harvest and those obtained in non-fan refrigerator cars enroute to eastern markets were correlated with the ability of the fruit to ripen satisfactorily at the market. Several railway protective services were used to obtain different temperatures in transit. By shipping two test cars on the same day, comparisons could be made between different icing and ventilating practices, such as, different amounts of initial ice with ventilation vs refrigeration and no ventilation for early and mid-season fruit; also immediate vs delayed icing, and ventilation with and without ice for shipments later in the season. The railroad protective service used for each car appears in Table 1. Table 2 contains car loading data.

Test Procedure.

Air temperatures were obtained in a tomato field near Carbona and in one near Tracy, California, Fig. 1. The sensitive elements of the recording thermometers were sheltered and held 10" above the ground surface. The tomatoes used for Test Lots 1 and 2 were grown near the Carbona station and those of Lot 3 near the Tracy station at elevations of 140' and 14' above sea level, respectively.

The temperature of the tomatoes while in transit to market was obtained by placing recording thermometers in the center of packed boxes of test fruit which were shipped as part of commercial loads. The test lot in each car consisted of four boxes of 6 x 7 bridge-pack tomatoes from fields near one of the temperature stations. Two of the test boxes were placed in the top doorway position of the load and two were placed in the bottom layer. Those in the bottom layer were set near the ice bunker in most instances but occasionally they had to be placed near the quarterlength of the car or at the doorway when the loading was partially completed before the test boxes were ready for shipment. Whenever two cars were shipped on the same day, boxes of fruit from the same test lot were placed in both cars. (Table 2)

After arrival at the market, the test boxes were inspected for ripeness (Table 3) before they were placed in a 68°F ripening room for further observation. Inspections during ripening were made at 3 or 4 day intervals at which time the fruits ready for prepacking were graded for salability and removed from the sample. The "rots" were also removed at each inspection. A 2 weeks' ripening period at the market was considered long enough for adequate comparison of the packout of the various test lots (Table 4). Additional data concerning the ripening of the test tomatoes at each shipping date were obtained by holding single box samples in California at 41°, 40°, 55°, and 68° for a simulated transit period of 10 days before shifting them to a 68° ripening room. These samples were inspected at frequent intervals and the fruits removed when "table ripe" or decayed (Table 5).

Further information primarily concerning the effect of transit temperature upon subsequent ripening of mature-green tomatoes was obtained by following samples of the commercial load from the test cars through the regular ripening and prepacking operations. To do this, 25 boxes from the top doorway position in the cars and 25 boxes from the bottom bunker position were marked for observation and inspected for ripeness, packout, and decay during a ripening period of approximately 2 weeks in commercial ripening rooms (Table 6). The causes of cullage in these commercial lots are shown in Table 7. Although the samples of the commercial lots were not always comparable, the packout of the fruit indicates in general the effect of transit temperature upon ripening.

The tomatoes were Pearson, a variety extensively grown in the Tracy district for fall harvest and were not staked.

Cars 1 to 4 were shipped over a northern route via Ogden, Utah. Cars 5 to 8 went "south" via El Paso, Texas. With the exception of Car 8 destined for Chicago, Illinois, all cars were delivered at Jersey City, New Jersey for the New York City market.

None of the cars were equipped with air circulating fans.

DISCUSSION OF RESULTS

Shipping Tests

Test Cars 1 and 2 were shipped October 1 before the advent of cold weather. Enroute to Ogden, Utah, a comparison was made between full-bunker initial icing, standard ventilation, and initial icing of 1-1/2 tons each bunker, vents closed. Both cars were treated alike thereafter with standard ventilation to Peoria, Illinois and diagonal ventilation beyond. They were re-iced to capacity at Peoria by order of the receiver.

Initially icing Car 1 with 1-1/2 tons each bunker and forwarding it with vents closed to Ogden provided adequate refrigeration for these tomatoes which had an initial temperature of 76°F (Fig. 2). Full-bunker icing cooled the 70° load in Car 2 more than necessary even with standard ventilation. Re-icing these cars at Peoria, 7th day enroute, was not necessary. These tomatoes which were 50° or below in the top as well as in the bottom of the loads at this point would not have warmed up much during the remainder of the trip.

The lower transit temperature in Car 2, initially iced to full capacity, is reflected in the 72 percent green fruit upon arrival (top layer test boxes) compared with 37 percent green in Car 1 (Table 3). In both cars the percentage of "greens" in the test boxes on arrival was much higher in the cold bottom layer of the load than in the relatively warmer top layer. Little difference was found between the two cars judging by the ripening of the test tomatoes into good and fair salability. Top layer boxes from both cars showed good packout with little decay in two weeks while the colder bottom layer boxes showed poor packout and considerable decay (Table 4).

With the commercial load there was not so much difference in the packout of the top and bottom layers of the loads as with the test boxes, but here too the fruit with the lowest temperature in transit had to be culled the most (Table 6).

Test Cars 3 and 4 (October 16) were shipped during cool weather but before there had been many cold nights. The loading temperatures were 61° and 69°F, respectively. Both cars were initially iced with 1 ton each bunker but for comparison, Car 3 had diagonal ventilation for the entire trip while Car 4 had vents closed to Kansas City, a period of about 5 days, and diagonal ventilation thereafter. Neither car was re-iced in transit.

Both cars had desirable temperatures in transit with minima between 45° and 58°F (Fig. 3). Car 3 cooled to a lower level than Car 4 owing to the lower temperature of the tomatoes at time of loading.

There was little ripening in transit in the test boxes in the top layer of "cold" Car 3 or in the bottom layer of either car where average temperatures in transit were 51° to 56°F compared with 19 percent firm ripe in the top layer of Car 4 where the average temperature was 63° (Table 3). The packout of this fruit was good from both cars with the best return coming from the warmest fruit (TD Car 4) and the poorest return from the coldest lot (BB Car 3) (Table 4).

With the commercial load, the packout was very good from both cars but still the coldest fruit had to be culled the most (Table 6).

Test Cars 5 and 6 were shipped October 23 after the fruit had accumulated 145 hours at temperatures between 40° and 50°F in the field. These cars were routed via El Paso, Texas and compared initial icing (1-1/2 tons each bunker) at Brentwood, California, vents closed to Tucson, Arizona, with no ice, diagonal ventilation to Tucson. Both cars were supplied 2 tons ice each bunker at this point and forwarded with diagonal ventilation.

The loading temperature of both cars was about 60°F. At Tucson, initially iced Car 6 was slightly colder in the top layer and considerably colder in the bottom layer than non-iced Car 5 (Fig. 4). The temperature record indicates that after the cars were iced at Tucson, Car 6 was forwarded with vents closed while Car 5 continued on with diagonal ventilation. Both cars had desirable temperatures for slow to moderate ripening in transit.

The inspection of the test boxes upon arrival at the market shows 47 and 43 percent firm ripe in the top layers of Cars 5 and 6, respectively, and 24 and 11 percent firm ripe in the somewhat colder bottom layers of the loads (Table 3). The packout in two weeks was high in the top layer boxes but considerably lower in those from the colder bottom layer (Table 4).

With the commercial loads, the packout was very good for both cars but the cullage was somewhat more in the relatively cold Car 6 (Table 6).

Test Car 7 was shipped via El Paso, October 31, after some unfavorable weather, including a rain on October 24-25 and two 36° to 38°F nights, October 27 and 28. This car was shipped standard ventilation, Tracy to destination, with 1-1/2 tons ice supplied each bunker at Colton, California, on the second day in transit.

The fruit was 60°F when loaded. It cooled slightly enroute to Colton (Fig. 5). Icing the car at this point and the cold weather that followed caused excessive cooling of the entire load. This was evidenced by the temperature record obtained in the bottom layer of the load and the little amount of ripening of the fruit in transit in the top as well as in the bottom layer boxes (Table 3). The poorest packout and excessive decay during 2 weeks ripening of this fruit at the market, as shown in Table 5, probably was due to chilling injury. This opinion is based on the fact that the tomatoes had been subjected to 231 hours of cooling below 50° in the field plus more than 8 days at temperatures continuously below 50° as indicated by the transit record of the bottom bunker position. No record was obtained of the packout of the commercial load.

Test Car 8 was shipped November 9. The weather between this test and Test 7 was clear with 40° to 45°F nights and 70° to 80° days. The temperature of the tomatoes when loaded was 64° and the car was shipped via El Paso, standard ventilation, no ice.

A desirable temperature of about 60°F was obtained in this car for the first 6 days in transit while normal temperatures prevailed outside (Fig. 6). Thereafter the load cooled only about 10° in 4 days time during which the outside temperature was continuously between 20° and 35°. Obviously all ventilators were closed by the railroad during this period. The ripening and packout of the test fruit in this car was good considering the lateness of the season and is in agreement with the holding tests (discussed later) indicating that tomatoes can withstand a considerable amount of low temperature in the field provided they are not subjected to excessive cooling in transit. The packout of the commercial load was not as good as that of the test lots but was in accord with the results of the holding tests in that the packout of good quality fruit may be reduced as the season progresses.

Holding Tests.

With the test samples held in California at constant temperatures of 68°, 55°, 50°, and 41°F for 10 days before they were shifted to 68° for ripening, the amount of good quality fruit when ripe was not materially reduced by a seasonal total of 145 hours at temperatures between 40° and 50° in the field provided the initial holding temperature simulating the transit period was 50° or above (Table 5 - Harvest of October 23). However, a temperature of 41° for the simulated transit period was difinitely detrimental to fruit picked October 1 and 16 with less than 100 hours at temperatures between 40° and 50° in the field. With the tomatoes picked October 30 and November 7, the amount of good quality fruit became less at all holding temperatures, indicating an adverse effect on ripening by continued cold weather before harvest but the loss was not so great at simulated transit conditions above 50° as it was below this temperature.

SUMMARY

The ripening behavior of California fall crop mature-green tomatoes following transit to eastern markets or following simulated transit periods point to the harmful role played by temperatures below 50°F. It appears that low transit temperatures (below 50°F) cause slow ripening and increased decay. As the season progresses, the amount of injury from slight chilling in transit seems to increase. This may be due to an accumulation of exposure to low temperature in the field.

The need of maintaining a uniform temperature above 50°F for mature-green tomatoes in transit is suggested. The temperature records obtained in this study indicate that an initial icing of 1-1/2 tons each bunker provides adequate refrigeration for tomatoes shipped during early October when the loading temperature is 70° to 75° and that 1 ton each bunker is adequate for 65° to 70° fruit. Re-icing after 4 or 5 days with 1 to 1-1/2 tons each bunker should be necessary only during abnormally hot weather enroute. Shipping Car 4 vents closed for a period of 5 days with only 1 ton initial ice in each bunker had no bad effect upon the subsequent ripening of the fruit at the market.

The common practice of having the vents open when ice is used may be undesirable except to accelerate ice meltage. There is some indication that open vents during the fall result in lower bottom layer temperatures than exist in closed cars.

The problem of maintaining uniform transit temperatures above 50°F after about mid-October calls for considerable judgment. With fruit exposed to a succession of cold nights before harvest the desirability of avoiding chilling transit conditions becomes increasingly more important. The most common fault is too much ice in late shipments. The use of fan cars with vents closed and limited icing or no ice may be a solution. The inspection of tomato cars enroute and the adjusting of the protective service to meet changing conditions has been tried in a limited way, but often the mistake of excessive icing at shipping point cannot be corrected without removing the ice at some point in transit. Additional experimental work is needed to determine practical methods of maintaining desired transit temperatures for late tomatoes. At present, standard ventilation or diagonal ventilation (with vents closed when the outside temperature drops below 45°F) appear to be adequate for shipments as early as mid-October if the pulp temperature is below 65°F at loading. At this time the weather enroute is normally cool.

In this report, hours below 50°F are presented as an indication of chilling exposure. However, it is realized that chilling injury may not occur necessarily from this simple relationship which does not give weight to the actual temperature reached. Degree hours below 50° might be a better value to use.

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The shippers shown in Table 1.

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M. A. Smith, G. B. Ramsey, A. L. Ryall, and R. E. Hardenburg, U. S. Department of Agriculture, Bureau of Plant Industry, Soils and Agricultural Engineering.

The map used for Figure 7 indicating average maximum and minimum temperatures for October at stations along western railroad lines was originally prepared from U.S. Weather Bureau records as of July 1, 1941, by the Office Of Manager, Perishable Freight Traffic, Southern Pacific Company, San Francisco, California, and is reproduced by permission.

TABLE 1. - PROTECTIVE SERVICES OF TEST CARS

Tomato shipping tests from the Tracy district of California, October and November, 1951.
Cars 1 to 7, included, unloaded at New York City; Car 8 unloaded at Chicago, Illinois.

Test Car	Date Shipped	Loading Temp. °F	Initial Ice(1	Re-ice	Ventilating Instructions(2
1	10/1	76	1½ tons per bunker - Stockton, California	Full Bunkers - Peoria, Illinois	Std. Vent. Patterson, Calif. to Stockton, Calif. V.C. Stockton to Ogden, Utah Std. Vent. Ogden to Peoria, Ill. V.O.D. Peoria to N. Y. City.
2	10/1	70	Full bunkers - Tracy, California	Full Bunkers - Peoria, Illinois	Std. Vent. Tracy to Peoria, Ill. V.O.D. Peoria to New York City
3	10/16	61	1 ton per bunker, Tracy, Calif.	None	V.O.D. Tracy to New York City
4	10/16	69	1 ton per bunker, Brentwood, California	None	V.C. Brentwood to Kansas City, Mo. V.O.D. Kansas City to New York City
5	10/23	60	2 ton per bunker, Tucson, Arizona	None	V.O.D. Tracy to New York City
6	10/23	63	1½ ton per bunker, Brentwood, California	2 ton per bunker - Tucson, Arizona	V.C. Brentwood to Tucson, Arizona V.O.D. Tucson to New York City
7	10/31	60	1½ ton per bunker, Colton, California	None	Std. Vent. Tracy to New York City
8	11/9	64	None	None	Std. Vent. Carbona, California to Chicago, Illinois.

(1 All cars loaded with empty bunkers.

(2 Std. Vent = All vents open above 45°F; closed below 45°F.
V.C.= Vents closed.
V.O.D.= One vent open each end diagonally across car - Also called Diagonal Ventilation or Special Ventilation
Vents manipulated according to standard ventilation for tomatoes.

TABLE 2. - LOADING INFORMATION

Tomato shipping tests from the Tracy district of California, October and November 1951
Cars 1 to 7, included, unloaded at New York City; Car 8 unloaded at Chicago, Illinois.

Test Car	1	2	3	4	5	6	7	8
Date	10/1	10/1	10/16	10/16	10/23	10/23	10/31	11/9
PFE	73913	95551	62018	44252	62615	90241	61142	42266
Route(1	North	North	North	North	South	South	South	South
Shipping Point	Patterson	Tracy	Tracy	Brentwood	Tracy	Brentwood	Tracy	Carbona
Shipper	Patterson Packing Co.	Cochran Co. Inc.	Cochran Co. Inc.	Western Fruit Growers	Cochran Co. Inc.	H. P. Garin Co.	Cochran Co. Inc.	Haymen & Covert
Commercial Load(2								
Brand	Kirby	Cockatoo	Cockatoo	Hillside	Cockatoo	Garintee Red Label	Cockatoo	Murra
Grade,% U.S.#1	88	98	98	98	98	98	98	95
Test Fruit(3								
Lot. No.	3	3	1	1	3	3	3	2
Source	Tracy	Tracy	Carbona	Carbona	Tracy	Tracy	Tracy	Carbona
Field Exposure Hrs. below 50°F	32	32	98	98	145	145	231	297
Grade,% U.S.#1	98	98	98	98	98	98	98	95

(1 North route via Ogden, Utah - South route via El Paso, Texas.
(2 All loads "Divided", 5 boxes crosswise of car, 5 layers high, 13 stacks in each end of car, totaling 650 boxes and weighing approximately 23,000 pounds.
(3 4, 6 x 7 "bridge pack" lugs in each car.

TABLE 3. - ARRIVAL CONDITION AND TRANSIT TEMPERATURES OF TEST PACKAGES

Tomato shipping tests from the Tracy district of California, October and November 1951.
Car 8 unloaded at Chicago, Illinois; all others at New York City.

Test Car	Date Loaded	Position In Car	TEMPERATURE			Hours to cool to 50°F	Hours Below 50°F	Days in Car	CONDITION UPON ARRIVAL(2				
			Loading	In-Transit Min.	In-Transit Ave.				Green	Turning	Firm-Ripe	Soft-Ripe	Decay
			°F	°F	°F				pct.	pct.	pct.	pct.	pct.
1	10/1	TD(1	75	45	53	120	216	14	37	41	22	0	0
		BB	77	37	49	84	252	14	67	28	5	0	0
2	10/1	TD	70	43	50	84	156	10	72	14	14	0	0
		BB	70	(No record----------			)	10	91	7	2	0	0
3	10/16	TD	61	51	56	--	0	10	85	9	6	0	0
		BB	61	44	51	48	132	10	73	26	1	0	0
4	10/16	TD	70	58	63	--	0	10	61	20	19	0	0
		BB	68	47	53	72	96	10	77	16	7	0	0
5	10/23	TD	60	56	60	--	0	13	11	42	47	0	0
		BQ	59	50	57	132	12	13	27	48	24	0	1
6	10/23	TD	63	54	56	--	0	13	16	40	43	0	1
		BQ	62	47	52	120	144	13	33	56	11	0	0
7	10/31	TD	60	40	(No record--------		)	12	60	32	7	0	1
		BB	60	37	45	84	204	12	74	22	3	0	1
8	11/9	TD	65	55	61	--	0	11	22	46	28	0	4
		BD	63	48	57	228	36	11	43	38	17	0	2

(1 TD=Top layer at doorway; BB=Bottom layer at bunker; BQ=Bottom layer at Quarterlength; BD=Bottom layer at doorway
All near center line of car.
(2 Average of 2 "Bridge Pack" boxes, 6 x 7 size, containing approximately 3-1/3 layers of fruit per box.

TABLE 4.

PACK-OUT OF TEST PACKAGES DURING TWO WEEKS OF RIPENING AT DESTINATION

Tomato shipping tests from the Tracy district of California, Oct. and Nov., 1951. Car 8 unloaded at Chicago; all others at New York City.

Test Car	Date Loaded	Position in Car	PACK-OUT DURING 2 WEEKS RIPENING AT 68°F (1 Ripes: Good	Ripes: Fair	Ripes: Poor	Ripes: Culls	Not Ripe	Decay
			pct.	pct.	pct.	pct.	pct.	pct.
1	10/1	TD(2	55	33	7	1	3	0
		BB	7	42	20	5	14	12
2	10/1	TD	71	20	1	0	8	1
		BB	27	22	5	1	36	9
3	10/16	TD	28	50	5	1	15	1
		BB	15	37	14	1	31	2
4	10/16	TD	41	50	3	0	4	1
		BB	26	46	8	0	19	1
5	10/23	TD	20	60	16	2	0	2
		BQ	16	46	26	5	3	4
6	10/23	TD	20	60	12	4	1	3
		BQ	12	56	20	2	6	4
7	10/31	TD	7	36	17	2	23	15
		BB	5	17	12	4	33	28
8	11/9	TD	50	24	11	3	4	8
		BD	46	28	12	3	7	4

(1 Average of 2 lugs of 6 x 7 "bridge pack", averaging 135 fruits per lug.

(2 See Table 3 for position designations.

TABLE 5.

RIPENING BEHAVIOR OF TEST SAMPLES UNDER SIMULATED TRANSIT CONDITIONS

Tomatoes from Test Lots 1 & 3 Held at Davis, California, October and November 1951.

Date of Harvest and Ripening Treatments	From Shipping Test Lot	Time Below 50°F In Field	Condition of Fruits when Table-Ripe (1				
			Good	Fair	Poor	Culls	Total Unmarketable
	No.	Hrs.	Pct.	Pct.	Pct.	Pct.	Pct.
Direct to 68° Ripening Room							
Oct. 1	3	32	87	10	2	1	3
16	1	98	83	16	0	1	1
23	3	145	90	8	1	1	2
30	3	218	73	12	5	10	15
Nov. 7	1	273	42	44	8	6	14
10 days 41° then to 68°							
Oct. 1	3	32	66	26	7	1	8
16	1	98	71	21	5	3	8
23	3	145	59	13	8	20	28
30	3	218	32	26	26	16	42
Nov. 7	1	273	11	39	5	45	50
10 days 50° then to 68°							
Oct. 1	3	32	92	7	0	1	1
16	1	98	72	24	4	0	4
23	3	145	80	12	4	4	8
30	3	218	61	25	10	4	14
Nov. 7	1	273	36	39	5	19	24
10 days 55° then to 68°							
Oct. 23	3	145	82	10	2	6	8
30	3	218	45	30	20	5	25

(1 One commercially packed lug (6 x 7, "Bridge-Pack") per treatment; each fruit rated as to condition when table-ripe.

Good and Fair - marketable at retail outlets.
Poor and Culls - unmarketable at retail outlets under most conditions.

TABLE 6. - PACK-OUT OF COMMERCIAL LOTS FROM TEST CARS AT DESTINATION (1

Tomato shipping tests from the Tracy district of California, October and November, 1951
Car 8 unloaded at Chicago; all others at New York City.

Test Car	Date Shipped	Position In Car	Aver. Temp. In Transit °F	Original Sorting		Final Sorting			
				Date	Ripe for Prepacking	Date	Ripe for Prepacking	Not Ripe	Culls(2
					Pct.		Pct.	Pct.	Pct.
1	10/1	TD	53	10/15	23	10/29	85	0	15
		BB	49		14		67	1	32
2	10/1	TD	50	10/15	33	10/29	89	0	11
		BB	--		5		78	1	21
3	10/16	TD	56	10/29	56	11/12	96	0	4
		BB	51		7		88	2	10
4	10/16	TD	63	10/26	82	11/9	97	0	3
		BB	53		46		92	0	8
5	10/23	TD	60	11/5	61	11/15	95	0	5
		BB	57(3		38		94	0	6
6	10/23	TD	56	11/5	63	11/15	87	0	13
		BB	52(3		39		83	0	17
7	10/31	No record of pack-out.							
8	11/9	TD	61	11/20	5	--	55	0	45
		BB	57(4		3	--	55	0	45

(1 Each lot consisted of 25 packed lugs from either the top doorway (TD) or the bottom bunker (BB) position of the load.

(2 See Table 7.

(3 From bottom quarterlength position.

(4 From bottom doorway position.

TABLE 7.

CLASSIFICATION OF CULLS IN COMMERCIAL LOTS(1

Tomato shipping tests from the Tracy district of California, Oct. and Nov. 1951.
All cars unloaded at New York City.

Test Car	Date Shipped	Position In Car	Mechanical Injury	Field Defects(2	Decay	Virus(3	"Soups"(4
			pct.	pct.	pct.	pct.	pct.
1	10/1	TD	5.02	8.14	1.63	0.00	0.39
		BB	7.13	9.61	9.51	1.60	4.73
2	10/1	TD	6.48	3.21	0.72	0.00	0.90
		BB	9.88	5.02	3.86	0.00	2.45
3	10/16	TD	1.18	1.58	0.39	0.12	0.47
		BB	3.96	2.24	1.35	0.17	2.22
4	10/16	TD	1.45	0.76	0.60	0.00	0.58
		BB	3.93	1.75	0.78	0.09	1.19
5	10/23	TD	1.73	1.42	0.65	0.12	1.26
		BB	1.98	1.65	1.26	0.22	0.89
6	10/23	TD	2.86	3.49	0.61	0.46	4.65
		BB	4.12	4.08	6.80	0.44	1.50
Average All Cars		TD	3.12	3.11	0.90	0.11	1.37
		BB	5.16	4.07	3.93	0.43	2.16

(1 Each lot consisted of 25 packed lugs from either the top doorway (TD) or the bottom bunker (BB) position of the load.

(2 Including severe puffiness.

(3 Virus mottle and waxy blister.

(4 Soft and poorly colored fruit, unsuitable for prepacking.

FIGURE 1

MAXIMUM AND MINIMUM AIR TEMPERATURE 10 IN. ABOVE GROUND LEVEL AND HOURS BELOW 50 F. IN TOMATO FIELDS NEAR CARBONA AND TRACY, CALIF. WHERE TEST SAMPLES WERE GROWN, September 21 to November 9, 1951

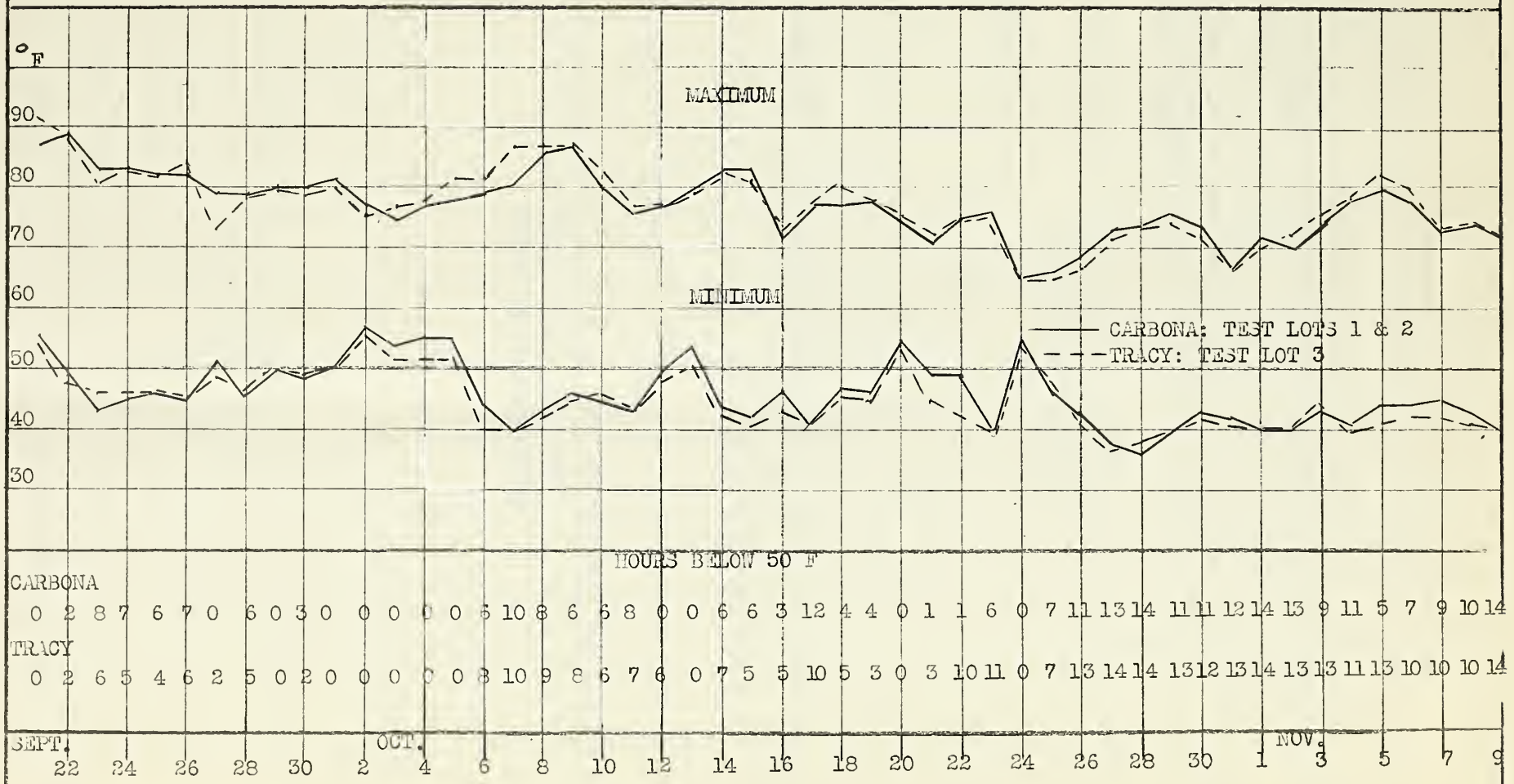


FIGURE 2

TEMPERATURE OF TOMATOES IN NON-FAN REFRIGERATOR CARS

PATTERSON AND TRACY, CALIF. TO NEW YORK CITY VIA OGDEN, UT. OCT. 1, 1951

CAR 1. INITIAL ICE 1-1/2 TONS EACH BUNKER AT STOCKTON, CALIF. 10/2. REICE TO CAPACITY AT PEORIA, ILL. 10/8. STANDARD VENTILATION PATTERSON TO STOCKTON, VENTS CLOSED STOCKTON TO OGDEN, STANDARD VENTILATION OGDEN TO PEORIA, DIAGONAL VENTILATION THEREAFTER. ARRIVED 10/11, UNLOADED 10/15.

CAR 2. INITIAL ICE TO CAPACITY AT TRACY, 10/1. REICE TO CAPACITY AT PEORIA, 10/8. STANDARD VENTILATION TRACY TO PEORIA, DIAGONAL VENTILATION THEREAFTER. ARRIVED 10/10, UNLOADED 10/11.

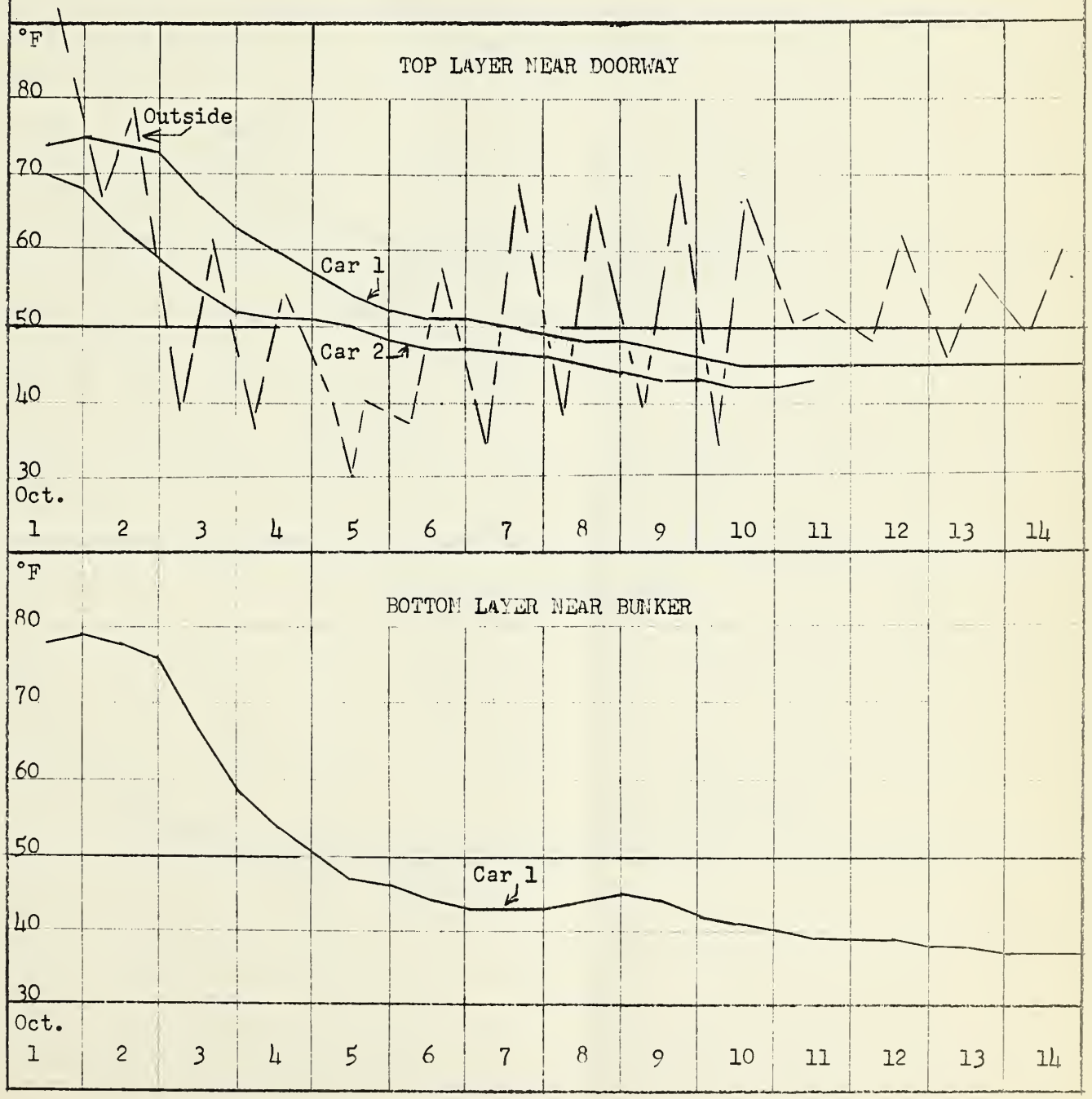


FIGURE 3

TEMPERATURE OF TOMATOES IN NON-FAN REFRIGERATOR CARS

TRACY AND BRENTWOOD, CALIF. TO NEW YORK CITY VIA OGDEN, UT. OCT. 16, 1951.

CAR 3. INITIAL ICE 1 TON EACH BUNKER AT TRACY, 10/16. DO NOT REICE. DIAGONAL VENTILATION TRACY TO DESTINATION. ARRIVED 10/25, UNLOADED 10/26.

CAR 4. INITIAL ICE 1 TON EACH BUNKER AT BRENTWOOD, 10/16. DO NOT REICE. VENTS CLOSED BRENTWOOD TO KANSAS CITY, MO. DIAGONAL VENTILATION THEREAFTER. ARRIVED 10/25, UNLOADED 10/26.

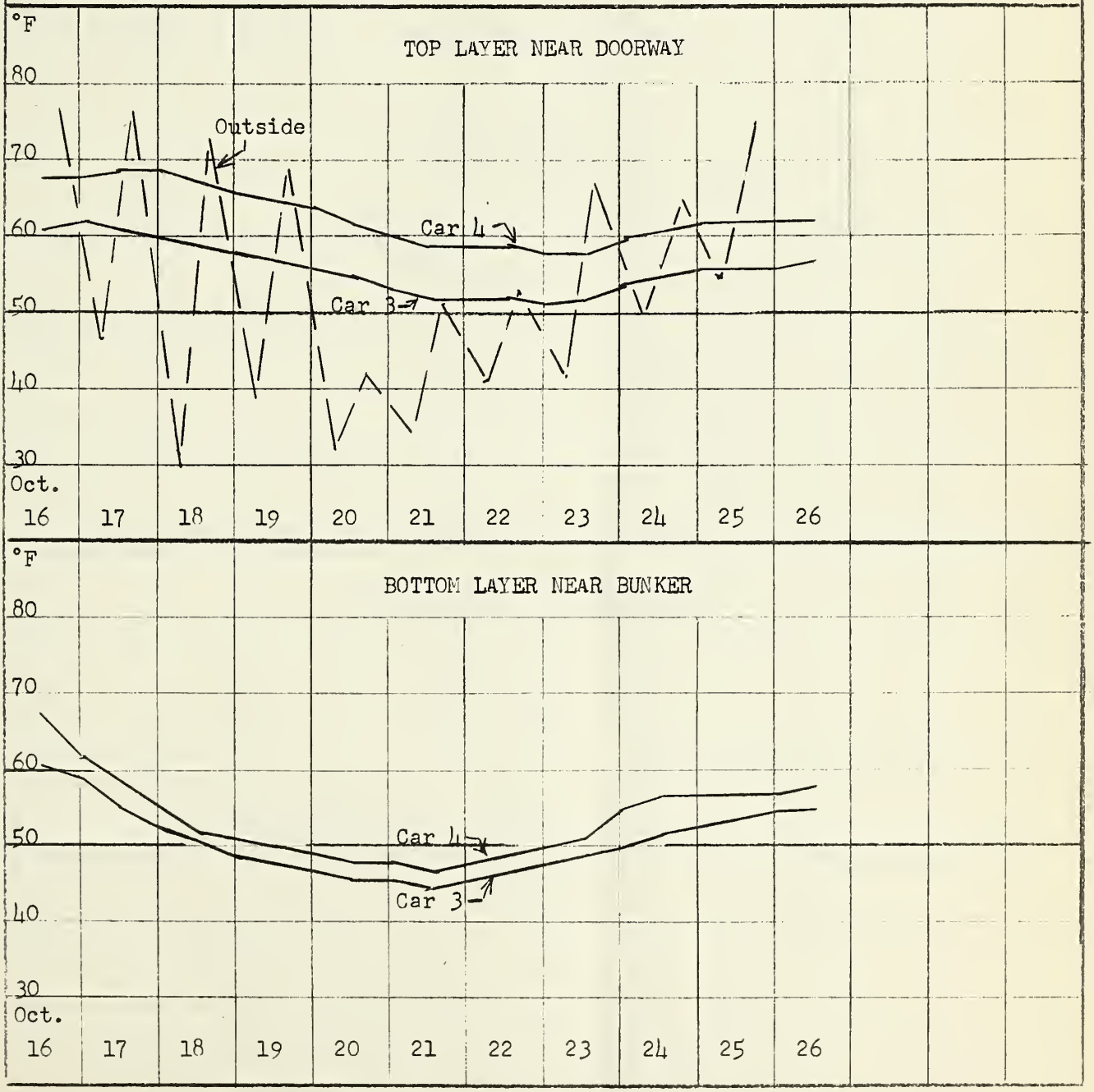


FIGURE 4

TEMPERATURE OF TOMATOES IN NON-FAN REFRIGERATOR CARS

TRACY AND BRENTWOOD, CALIF. TO NEW YORK CITY VIA EL PASO, TEXAS, OCT. 23, 1951.

CAR 5. INITIAL ICE 2 TONS EACH BUNKER AT TUCSON, ARIZ. DO NOT REICE. DIAGONAL VENTILATION TRACY TO DESTINATION. ARRIVED 11/3, UNLOADED 11/5.

CAR 6. INITIAL ICE 1-1/2 TONS EACH BUNKER AT BRENTWOOD 10/23. REICE 2 TONS EACH BUNKER AT TUCSON 10/27. VENTS CLOSED BRENTWOOD TO TUCSON, DIAGONAL VENTILATION THEREAFTER. ARRIVED 11/3, UNLOADED 11/5.

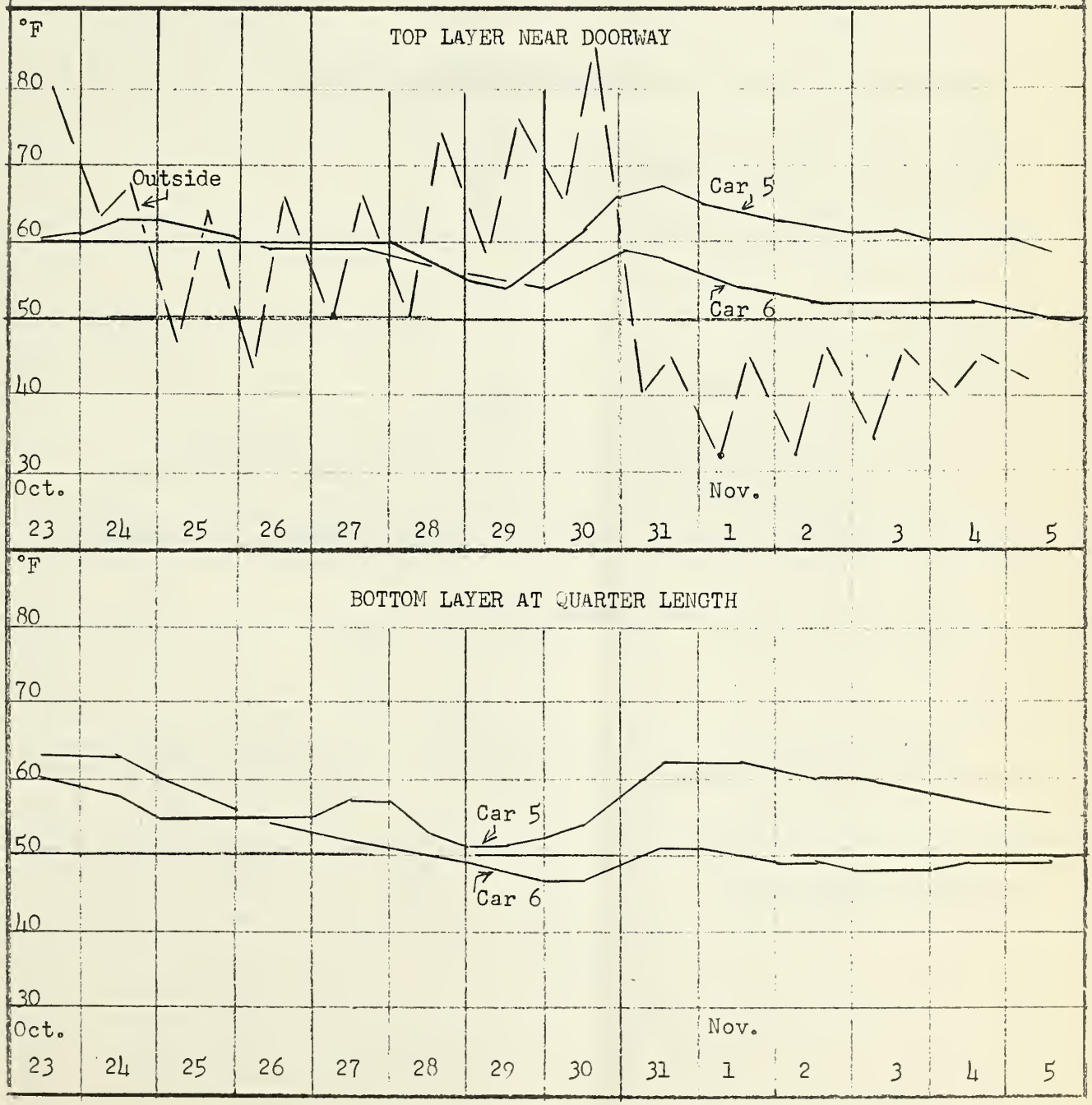


FIGURE 5

TEMPERATURE OF TOMATOES IN A NON-FAN REFRIGERATOR CAR
TRACY, CALIF. TO NEW YORK CITY VIA EL PASO, TEXAS. OCT. 31, 1951.

CAR 7. INITIAL ICE 1-1/2 TONS EACH BUNKER AT COLTON, CALIF. 11/2
STANDARD VENTILATION TRACY TO DESTINATION. ARRIVED 11/10, UNLOADED 11/12

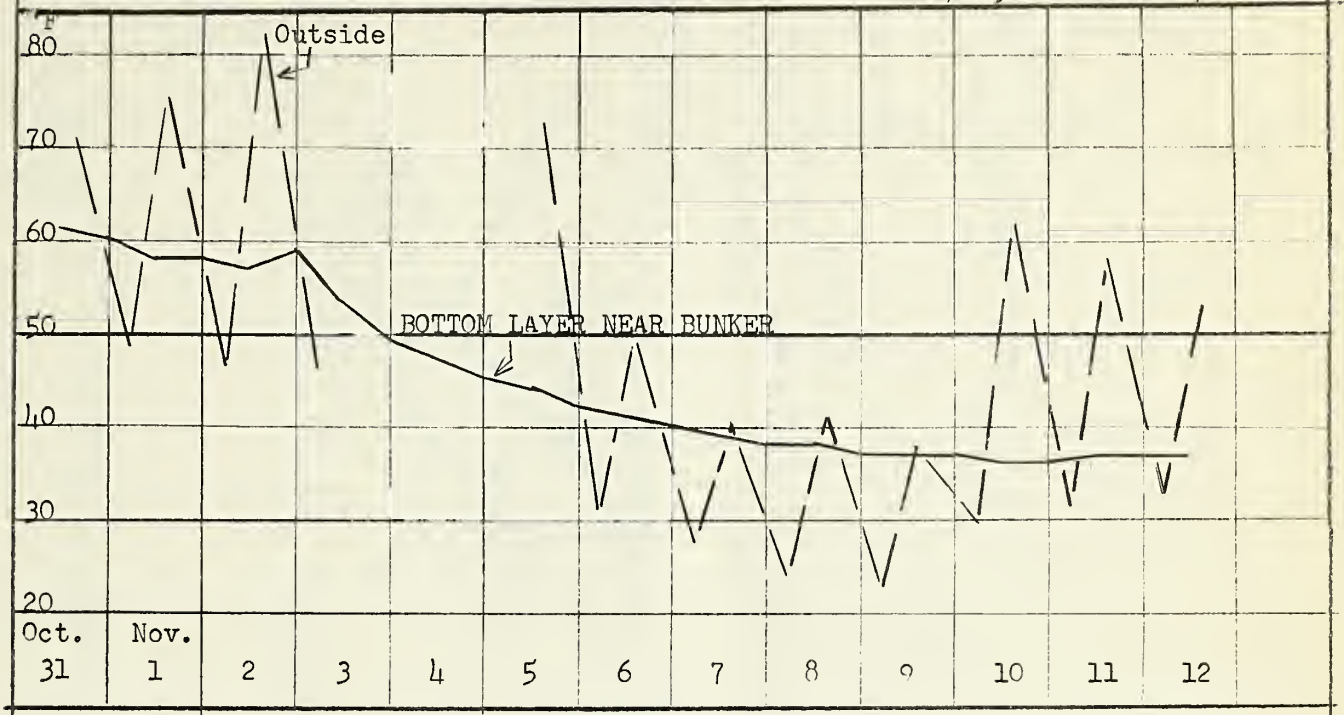
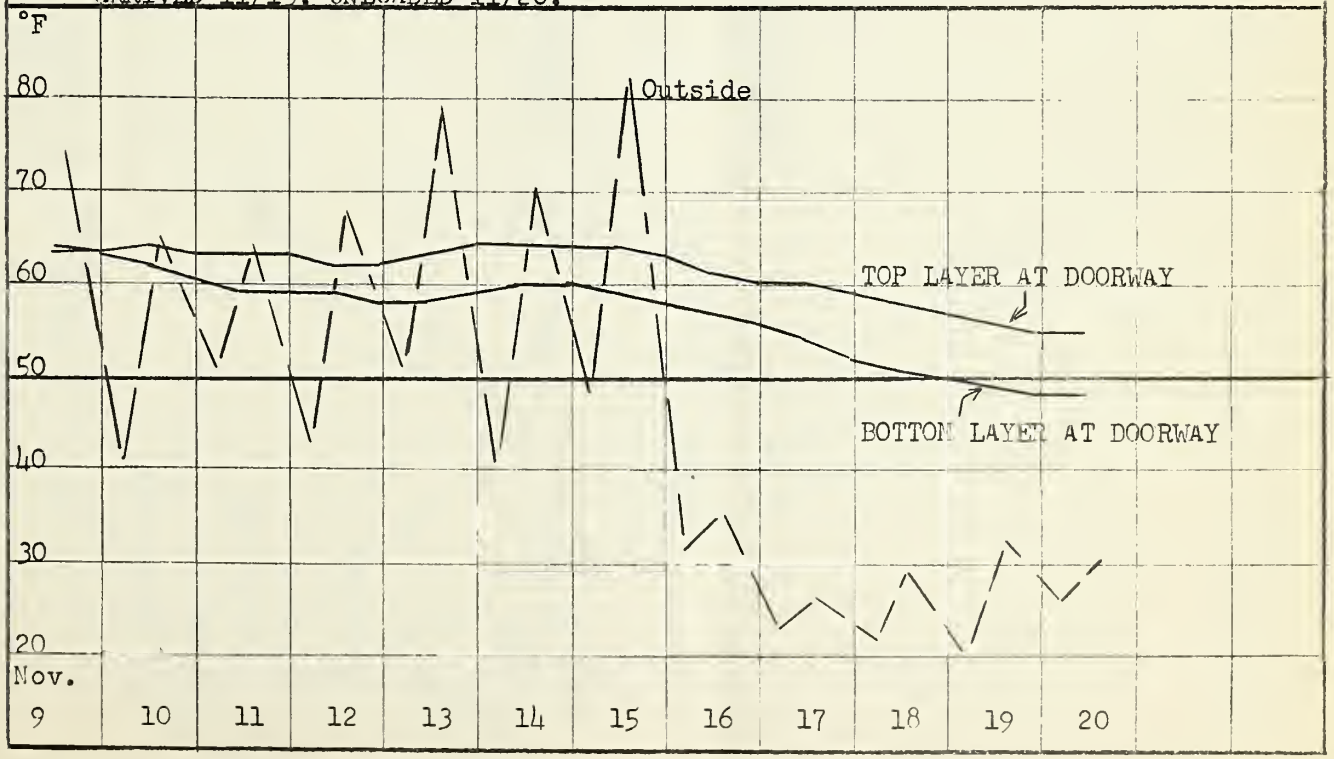
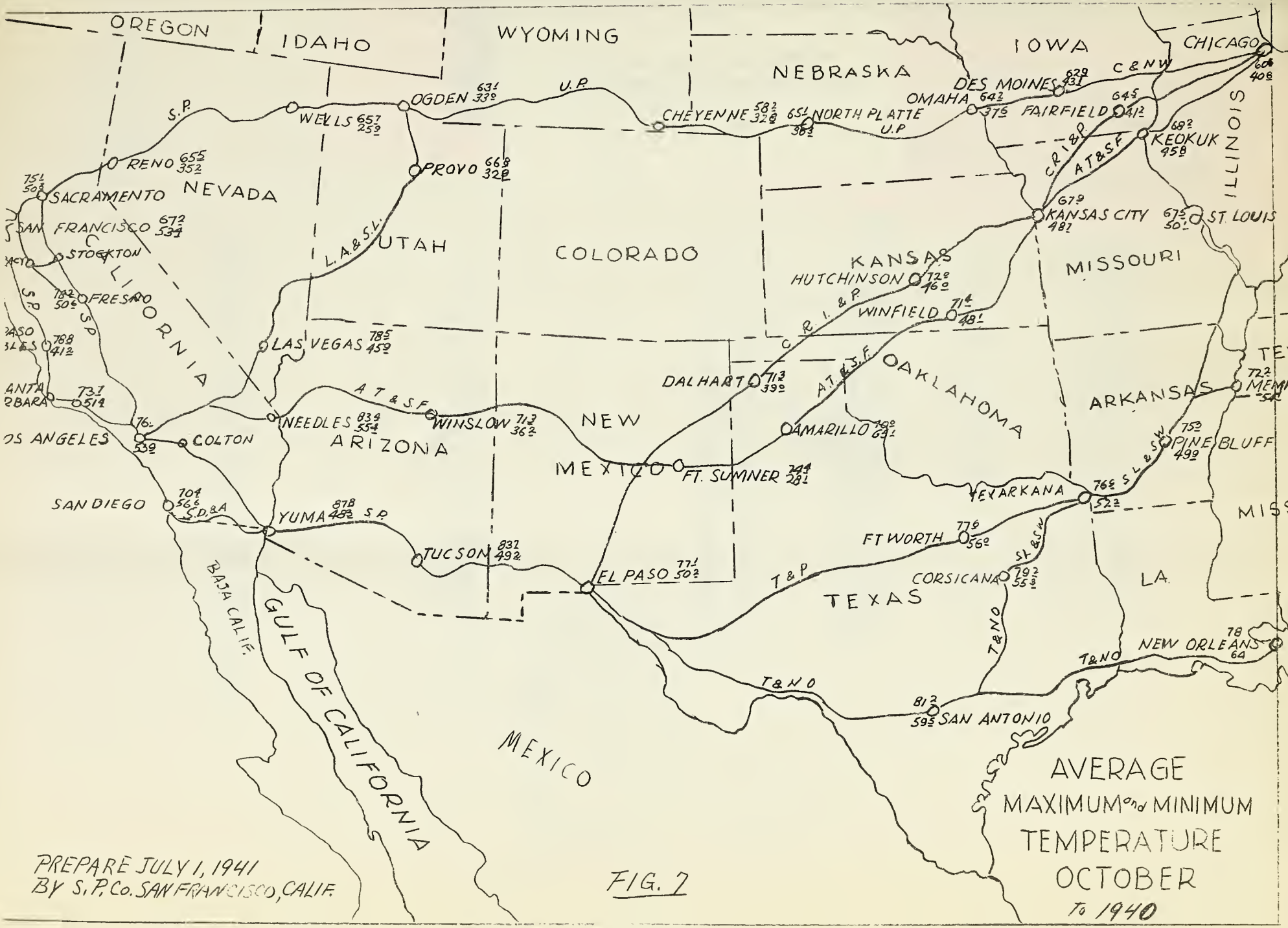


FIGURE 6

TEMPERATURE OF TOMATOES IN A NON-FAN REFRIGERATOR CAR
CARBONA, CALIF. TO CHICAGO, ILL. VIA EL PASO, TEXAS. NOV. 9, 1951.

CAR 8. NO ICE. STANDARD VENTILATION CARBONA TO DESTINATION.
ARRIVED 11/15. UNLOADED 11/20.




OREGON
IDAHO
WYOMING
NEBRASKA
IOWA
CHICAGO
ILLINOIS
NEVADA
UTAH
COLORADO
KANSAS
MISSOURI
ARKANSAS
OKLAHOMA
TEXAS
NEW MEXICO
ARIZONA
CALIFORNIA
MEXICO
SACRAMENTO
SAN FRANCISCO
STOCKTON
FRESNO
RENO
WELLS
OGDEN
PROVO
CHEYENNE
NORTH PLATTE
OMAHA
DES MOINES
FAIRFIELD
KEOKUK
KANSAS CITY
ST. LOUIS
HUTCHINSON
WINFIELD
LAS VEGAS
NEEDLES
WINSLOW
DALHART
AMARILLO
FT. SUMNER
EL PASO
TUCSON
YUMA
SAN DIEGO
LOS ANGELES
COLTON
SANTA BARBARA
TEXARKANA
PINE BLUFF
FT WORTH
CORSICANA
SAN ANTONIO
NEW ORLEANS
MEMPHIS
S.P.
U.P.
A.T.&S.F.
C.R.I.&P.
T&P
SL&SW
T&NO
L.A.&S.L.
SD&A
BAJA CALIF.
GULF OF CALIFORNIA
AVERAGE
MAXIMUM and MINIMUM
TEMPERATURE
OCTOBER
To 1940
PREPARE JULY 1, 1941
BY S. P. Co. SAN FRANCISCO, CALIF.
FIG. 7